

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : SEIKO EPSON CORP

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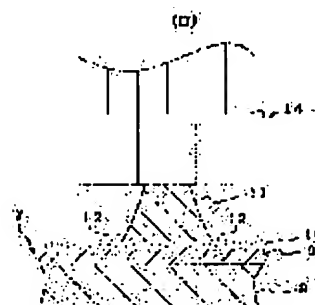
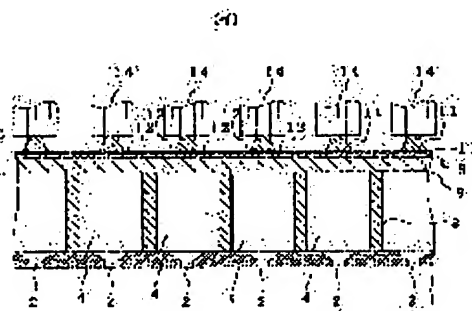
(72)Inventor : KITAHARA TSUYOSHI

## (54) INK-JET RECORDING HEAD AND PRODUCTION OF ELASTIC PLATE THEREOF

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To restrain the vaporization of an ink solvent without deteriorating the volume change efficiency in a pressure generating room by providing an elastic plate with a polymer film having a metal island part formed thereon, and forming an air blocking layer on the surface of the area to be a diaphragm part.

**SOLUTION:** A thin plate obtained by rolling to about 10 to 50  $\mu\text{m}$  thickness a material with a high rigidity such as a metal or the like, and to be etched such as an anti-corrosive steel or the like, formed in a shape suitable for changing the volume of a pressure generating room 4, is formed as an island part 11 on the surface of a polymer film base material via an adhesive layer 9 formed as thin as possible, and an air blocking layer 10 made from a material having the corrosion resistance with respect to an etching agent and a high air blocking property such as silica, alumina, or the like. A diaphragm part 12 comprising an elastically deformable polymer stretch film 8 and the air blocking layer 10 made from silica, alumina, or the like, are formed in the area facing to the pressure generating room 4 so as to surround the island part 11.



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The field of the technique in which invention belongs] This invention relates to the structure of the ink jet type recording head which makes a piezoelectric transducer a driving source, and the elastic plate which receives telescopic motion of a piezoelectric transducer in a detail more, contracts a pressure generating room and is expanded.

[0002]

[Description of the Prior Art] In order to aim at improvement in the recording density of a recording head, it is in the inclination for the pitch of a nozzle orifice train to become small, for this reason, anisotropic etching of the wafer of a silicon single crystal is carried out, the nozzle plate and elastic plate which were manufactured by this by other approaches are fixed with adhesives, a passage unit is constituted, transmit the variation rate of a piezoelectric transducer to an elastic plate, and a pressure generating room is made to generate a pressure, and it is constituted so that an ink droplet may be made to breathe out from a nozzle orifice with this pressure.

[0003] Thus, the \*\* sake to which the width of face of a pressure generating room will become very small if the array consistency of a pressure generating room becomes large, So that WO 93/No. 25390 description may see on the need of making the whole longitudinal direction of a pressure generating room transforming efficiently on one front face of metaled sheet metal While forming the layer of polymeric materials with dip coating, the roll coat method, a spray method, etc., etching metaled sheet metal and forming the island section by constituting the polymeric-materials layer exposed by etching as the diaphragm section, a piezoelectric transducer is contacted through the island section -- making -- having -- the variation rate of a piezoelectric transducer -- pressure generating -- making it transmit to the whole chamber efficiently is proposed.

[0004]

[Problem(s) to be Solved by the Invention] On the other hand, when the class of ink is diversified with the improvement of a quality of printed character and volatile high ink is used, as compared with a metal, the solvent of the ink of a pressure generating room vaporizes from a poly membrane with the low degree of \*\*\*\*, and there is a problem that the viscosity of ink rises and the dependability of printing actuation falls. The place which this invention is made in view of such a problem, and is made into the object is offering the ink jet type recording head which can stop the vaporization of the ink solvent from a pressure generating room, without dropping the effectiveness of volume change of a pressure generating room.

[0005] Other objects of this invention are proposing the manufacture approach of the elastic plate suitable for the above-mentioned ink jet type recording head.

[0006]

[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. The nozzle plate in which the nozzle orifice was drilled, and the spacer which forms the pressure generating room which is open for free passage to said nozzle orifice, The passage unit which comes to join the elastic

plate which equipped with the diaphragm section and the island section the location which counters said pressure generating room, In the ink jet type recording head which consists of a piezoelectric transducer in which said diaphragm section carries out elastic deformation in contact with said island section Said elastic plate forms the metaled island section in a high polymer film, is constituted, and formed \*\*\*\*\* in the front face of said field which serves as the diaphragm section at least.

[0007]

[Function] If the solvent of ink tends to permeate a high polymer film and tends to vaporize to atmospheric air, \*\*\*\*\* of the front face of the high polymer film which constitutes the diaphragm section will prevent passage of an ink solvent, and will prevent viscosity lifting of the ink of the pressure generating interior of a room.

[0008]

[Example] Then, based on the example illustrating the detail of this invention, it explains below.

Drawing 1 and drawing 2 show one example of the ink jet type recording head of this invention, respectively, and it is the member to which nozzle orifices 2 and 2, the nozzle plate in which 2 .... was drilled, and 3 are spacers, and the sign 1 in drawing divides the pressure generating room 4, the ink feed hopper 5, and a reservoir 6.

[0009] 7 is the elastic plate by which this invention is characterized, and as shown in drawing 3 , it uses as a base material the high polymer films 8, such as thickness 2 thru/or 10-micrometer polyphenylene sulfide (PPS) resin, and this thing preferably film-ized by the drawing. Have corrosion resistance in the thin adhesives layer 9 and an etching agent as much as possible on the surface of this, and thickness 100 thru/or about 1000A \*\*\*\*\* 10 are minded for a high ingredient, for example, the silica, an alumina, etc. of air barrier property. It is formed so that the island section 11 which operated orthopedically the sheet metal which rolled out the ingredient which metaled rigidity can be high and can etch, for example, stainless steel etc., to thickness 10 thru/or about 50 micrometers in the configuration of having been suitable for changing the volume of the pressure generating room 4 may correspond to the pressure generating room 4.

[0010] Thereby, the diaphragm section 12 which consists of \*\*\*\*\* 10, such as the macromolecule oriented film 8 in which elastic deformation is possible, a silica, and an alumina, so that the island section 11 may be surrounded is formed in the field which counters the pressure generating room 4. The macromolecule oriented film 8 becomes possible [ being able to prevent certainly leakage of the ink from the pressure generating room 4, and constituting a reliable ink jet type recording head from a process of film-izing, if it is used as an ingredient which constitutes the diaphragm section 11, since there is no generating of a pinhole etc. ].

[0011] It is joined by adhesives and this elastic plate 7 and a nozzle plate 1 constitute the passage unit 13 so that both sides of a spacing member 3 may be closed.

[0012] The sign 14 in drawing is a piezoelectric transducer, it carries out the laminating of the electrode 15 used as one pole, and the electrode 16 used as the pole of another side to the shape of sandwiches through piezoelectric material 17, expose one electrode 15 to a head side, and exposes the electrode 17 of another side to a back end side, is constituted, makes a head contact the island section 11, and is being fixed to the head frame 19 through the stationary plate 18.

[0013] In this example, if it is impressed by the driving signal and a piezoelectric transducer 14 is charged, a piezoelectric transducer 14 will contract and the pressure generating room 4 will expand. Thereby, the ink of a reservoir 6 flows into the pressure generating room 14 via the ink feed hopper 5.

[0014] If the charge of a piezoelectric transducer 14 is made to discharge, a piezoelectric transducer 14 will develop in the original condition, and the pressure generating room 4 will contract. The variation rate of a piezoelectric transducer 14 is uniformly transmitted to the longitudinal direction of the pressure generating room 4 by the island section 11, the diaphragm section 12 which consists of a high polymer film carries out elastic deformation, and the volume of the pressure generating room 4 contracts it. Thereby, the ink of the pressure generating room 4 is pressurized and the regurgitation is carried out as an ink droplet from a nozzle orifice 2.

[0015] On the other hand, if put on the condition that the passage unit 13 was filled up with ink, the

solvent of ink tends to permeate a high polymer film 8, and tends to vaporize to atmospheric air, but since \*\*\*\*\* 10 formed in the front face of a high polymer film 8 prevents passage of an ink solvent, viscosity lifting of the ink in the pressure generating room 4 is prevented.

[0016] Next, the manufacture approach of the elastic plate 7 mentioned above is explained. The sheet metal 20 of a metal with a thickness of 20 micrometers which can be etched, for example, a stainless steel plate, is prepared ( drawing 3 (I)), and it has corrosion resistance in one [ at least ] field of this at an etching agent, and sputtering of a high ingredient, for example, the silica, an alumina, etc. of air barrier property is carried out by about 500A thickness, and \*\*\*\*\* 21 is formed ( drawing 3 (II)).

[0017] After applying adhesives 22 to the front face of \*\*\*\*\* 21 and pre drying adhesives, the oriented film 23 of polyphenylene sulfide (PPS) resin with a thickness of about 4 micrometers is pasted up, and a laminate material 24 is constituted ( drawing 3 (III)). At this desiccation process, the solvent of adhesives 22 can permeate the macromolecule oriented film 23 with which one field is opened by atmospheric air, and can vaporize to atmospheric air, and the air bubbles by the solvent do not remain between \*\*\*\*\* 21.

[0018] The photopolymer film 25 is exposed using the mask which stuck the photopolymer film 25 on the front face of the stainless steel plate 20 of a laminate material 24, and formed the pattern which should be etched, and an etching protective coat is formed in the field used as the island section 11 ( drawing 3 (IV)).

[0019] Subsequently, if a laminate material 25 is etched using this etching protective coat, the island section surrounded by the diaphragm section which consists of a macromolecule oriented film 23 which etching stopped by \*\*\*\*\* 21 and was equipped with \*\*\*\*\* 21 and the adhesives layer 22 will be formed ( drawing 3 (V)). Since not only the adhesives layer 22 but also the front face is covered with \*\*\*\*\* 21 with high etching-proof nature, breakage is not received at an etching process. An elastic plate is completed by removing the photopolymer film 25 after termination of etching ( drawing 3 (VI)).

[0020] In addition, although an above-mentioned example sets and stainless steel is used as a metallic thin plate, it can etch and, moreover, the sheet metal of other adhesive high metals, for example, copper, nickel, iron, and silicon can be used.

[0021] Moreover, although polyphenylene sulfide (PPS) resin is used as a macromolecule oriented film Other polymeric materials which can be extended, for example, polyimide (PI) resin, polyether imide (PEI) resin, Boria MIDOIMIDO (PAI) resin, Pori Balaban acid (PPA) resin, Poly ape phone (PSF) resin, polyether sulphone (PES) resin resin, Polyether ketone (PEK) resin, polyether ether ketone (PEEK) resin, Polyolefine (APO) resin, polyethylenenaphthalate (PEN) resin, aramid resin, polypropylene resin, vinylidene chloride resin, poly car NETO resin, etc. can also be used.

[0022]

[Effect of the Invention] As mentioned above, since \*\*\*\*\* was formed in the front face of the field of the elastic plate constituted by forming the metaled island section in a high polymer film in this invention which serves as the diaphragm section at least as explained, a high polymer film can be permeated, the solvent of the ink which is going to vaporize to atmospheric air can be prevented by \*\*\*\*\* , and viscosity lifting of the ink of the pressure generating interior of a room can be prevented.

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[Translation done.]

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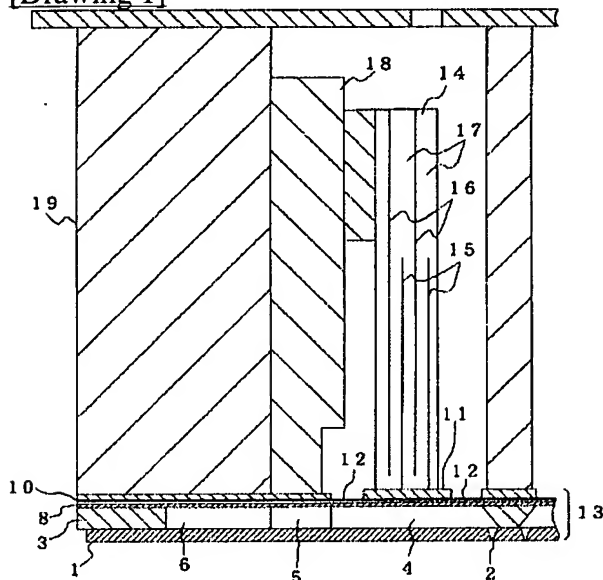
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DRAWINGS

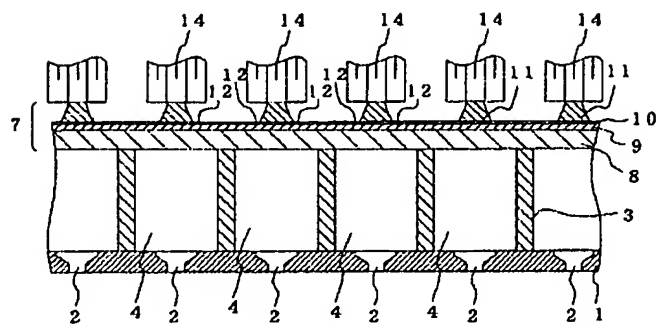
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[Drawing 1]

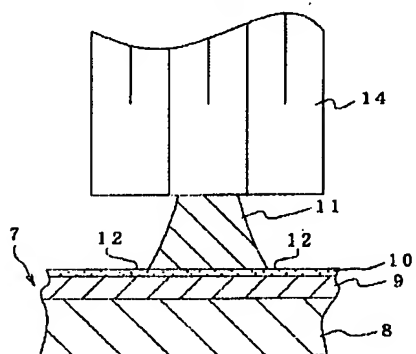


[Drawing 2]

(1)



(11)



[Drawing 3]

